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Making Detergents from Organic Waste Products

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ABSTRACT

The development of the food processing industry from agricultural products is always accompanied by environmental pollution because of the disposal of organic waste products. Therefore, utilizing organic waste products to create useful products is important both economically and in terms of environmental protection. This study presents some ways to utilize organic waste to create useful products. Agricultural waste sources such as lemon peels, grapefruit peels, and orange peels, etc. can be considered important raw materials for making detergents or natural soaps, or can also be extracted to obtain compounds and useful organic substances.

Keywords: Agriculture; By-product; Organic waste; Extract; Frying oil; Detergent; Soap; Active compound; Orange peels; Grapefruit peels.

1. Introduction

Organic waste, which includes substances from everyday sources such as food, papers, and other biological materials, is becoming one of the world's most serious environmental and social problems. Rapid population growth, economic development, and consumer lifestyles are contributing to increasing amounts of organic waste every day. Below is an overview of the current state of this problem and its consequences for the environment and society.

Organic waste accounts for a large portion of the total amount of household waste generated daily around the world. According to data from environmental research organizations, billions of tons of organic waste are generated each year, and this trend is increasing yearly. The sudden increase in population and economic development is driving the consumption of household products and food, generating a huge amount of organic waste [1]. Organic waste not only causes environmental pollution but also affects the ecosystem and human health. When left unchecked, organic waste can produce methane, one of the most powerful greenhouse gases, contributing to global climate change. In addition, the process of decomposing organic waste can also cause deterioration of soil and water quality, affecting agricultural production and local ecology [2]. The waste management system is facing great pressure from the increase in organic waste. Landfills are becoming overloaded, while traditional disposal methods such as incineration also face environmental and health difficulties. Many countries and regions are facing the challenge of treating and eliminating organic waste effectively and sustainably. Organic waste not only affects the environment but also has social and economic consequences for the community. Poor areas are often more severely affected by environmental pollution caused by organic waste, while people living in these areas often do not have the conditions or resources to handle waste safely. In addition, the food and bioprocessing industries also face the challenge of effectively managing and processing organic waste [3].

However, organic waste also offers opportunities for recycling and reusing resources. Substances from organic waste can be recycled to produce renewable energy such as biogas or biodiesel, thereby helping to reduce waste and

create clean energy. Developments in the field of environmental technology also open up opportunities to solve the organic waste problem. New technology such as biodegradation and chemical recycling can help us process organic waste more effectively and sustainably. Developments in this area could bring great benefits to the environment as well [4]. Organic waste is becoming one of the most serious problems for the environment and human health globally. In a world where consumption is increasing and the vision of environmental protection is increasingly emphasized, research and development of innovative solutions to reduce organic waste becomes urgent, in making detergents from organic waste is an urgent issue that has both scientific significance and environmental protection.

2. Research on making detergents from organic waste

Bharvi, S.P. et al. (2021) have studied the effects of organic solid waste in the form of orange peels, marigold flowers, and neem leaves on daily life wastewater treatment. Ecological enzyme solution was prepared using Dr. Rosukon's method from the above-mentioned waste which involves mixing jaggery with waste and water in a ratio of 1:3:10. The ecological enzyme solution is then prepared is allowed to prepare through a 90-day fermentation process. Three ecological enzyme solutions – after 10 days of use filtered – then mixed with individual domestic wastewater samples, retaining 90% wastewater and 10% ecological enzyme solution. The results after a 50-day digestion period showed that the orange eco-enzyme was the most effective in reducing total dissolved solids (TDS) while the Marigold eco-enzyme was most effective in reducing chemical oxygen demand (COD) [5]. Chin, W. et al. (2021) have transferred fresh fruit and plant waste into ecological enzymes for wastewater treatment, creating clean water. The source and cleaning of gray and black water before discharging into the environment are important factors in protecting public health worldwide. The objective of this study is to make full use of food waste in wastewater treatment. The production of ecological enzymes is done through the process of fermentation of fresh fruit and plant waste. In this study, ecological enzymes were produced from waste derived from vegetables and fruits. The plant eco-enzymes were fermented through *S. cerevisiae* for a total of 7 days. Ecological enzymes produced from fruit are fermented with brown sugar for three months with the indigenous bacterial population present in the fruit fermentation substance [6]. Dark brown liquid eco-enzyme was produced by fermentation of fruit waste. The resulting solution has a strong sweet and sour fermented scent due to the citrus fruit peel. Ecological enzymes produced from fruit peel, water, and brown sugar in a ratio of 3:10:1. After incubation, the filtrate was obtained, we noticed. Flavonoids, Alkaloids, Quinones, and Saponins are the presence of various metabolites. Its IR spectrum shows the presence of -OH, and COOH groups. In addition, Amylase, protease, and lipase were also found in the filtrate. The above-mentioned separation solution is available for possible applications such as cleaning floors, utensils, gardening, etc. Thus, taking advantage of organic waste such as orange and tangerine peels to recycle and reuse will help reduce waste, be environmentally friendly, and save money with multi-purpose applications [7]. Many people in the world do not have access to sanitary conditions leads to the contagion of bacterial infection from one person to another. Prarthana Prashanth's research team has created and developed absorbent antibacterial towels made from fruit peels and recycled paper for hand hygiene. This product is accessible, sustainable, and environmentally friendly. Kiwi, orange, and lemon peels are chosen for this because they contain antibacterial elements such as vitamin C and citric acid as well as water-absorbing cellulose. Sanitary towels are typically

manufactured with a mixture of crushed fruit peels and paper and then dried thin film on the screen. Sanitary towels were tested for inhibition of bacterial growth and water absorption. The towels were incubated with Escherichia coli and bacteria. Survival rate was measured by counting colonies above the agar plate. The results showed that sanitary towels can kill up to 91% of bacteria, showing potential. The product is environmentally friendly and has high antibacterial properties [8].

3. Some typical processes for making detergents from organic waste

3.1. Process for producing detergent from grapefruit peel

Organic waste raw materials come from grapefruit peels, lemon peels, and orange and lemon peels with a pleasant aroma, are most suitable for household cleaning and are chosen to make detergent. To produce 10 liters of cleaning liquid we used the following ingredients: 3 kg of plant-based waste; 1 kg of brown cane sugar (or 500 ml of raw dishwashing liquid from the pre-fermenting process; 10 liters of clean water; 0.5 kg of dried soapberry to create foam and some essential oils for flavor aromatic (Figure 1).

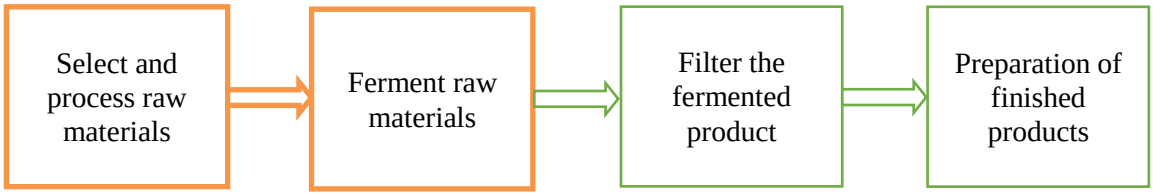

Figure 1. Process for making detergent

The starting materials need to be cleaned to remove impurities, making the fermentation process easier and avoiding spoilage of the materials. Then, the ingredients are fermented. This is an important step that determines the quality of dishwashing liquid. During the fermentation process, we can see that the surface of the compost mixture has a white layer, this is the dead microorganisms floating up. If you continue to cover it tightly, after a few weeks the white scum will disappear and will not affect the quality of the fermented product. After a period of incubation and fermentation of about 40-45 days, a solution with a characteristic fragrant, slightly sour smell is obtained. The fermented material is completely decomposed, proving that the fermentation process has been completed. Finally, the solution is filtered with the cloth to remove plant residue and extracted into small bottles to obtain a crude detergent solution. Leave the solution for 1-2 days to let the residue settle, then extract the clear solution above and use it to produce dishwashing liquid, glass cleaner, and house cleaner. Biological detergent is created by fermenting grapefruit peel – a type of organic waste that is safe for users and the environment. The fermentation process produces ethyl alcohol and acetic acid, which are two substances with good cleaning abilities.

3.2. Waste frying oil is combined with orange peel extract to prepare soap

The waste frying oil is studied to prepare three different types of detergents such as soap, liquid soap, and soap powder through the saponification process. The soap base preparation conditions were optimized by orthogonal experiments. Specific preparation processes include waste frying oil treatment, orange peel extract preparation, saponification, molding, and drying. The results show that the optimal conditions for the saponification process are as follows: ratio of pure frying oil and coconut oil = 6:4, lye solution (NaOH) mass fraction 30%, saponification

temperature 70 °C, orange peel extract concentration 15%. The mature soap is then used to make liquid soap and soap powder by adding surfactants (sodium dodecylbenzene sulfonate, coconut diethanol amide), followed by grinding. Detergents formulated according to manufacturing standards have strong decontamination capabilities, stable performance, are gentle on the skin, and are non-toxic [9].

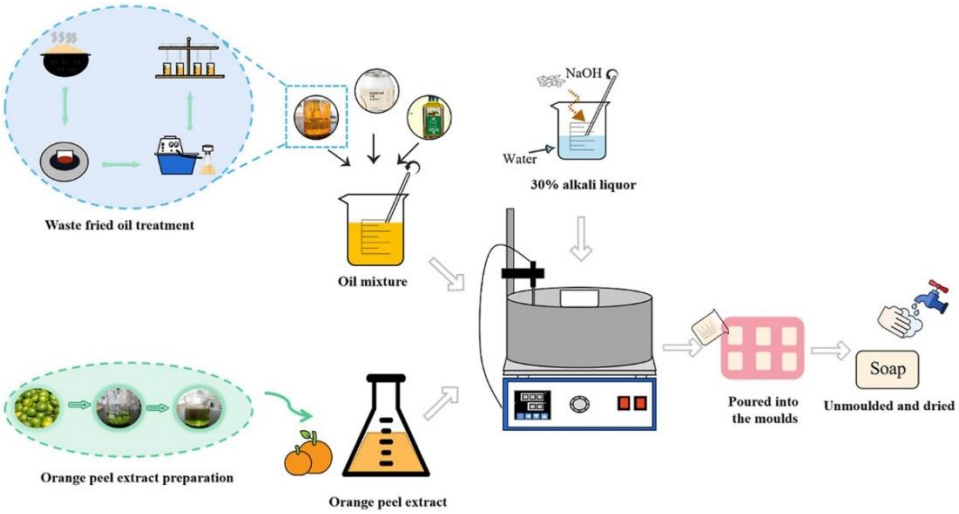

Figure 2. Diagram of soap preparation from waste frying oil and orange peel extract [9]

3.3. Production of biofuels and valuable compounds by fermentation of citrus peels

Citrus is the largest-grown fruit crop in the world. About 45–55% of whole fruit after processing is usually discarded by food processing industries as waste. Waste is a major environmental problem in terms of soil and water pollution along with aesthetic dissatisfaction and the spread of disease due to its high fermentable sugar content.

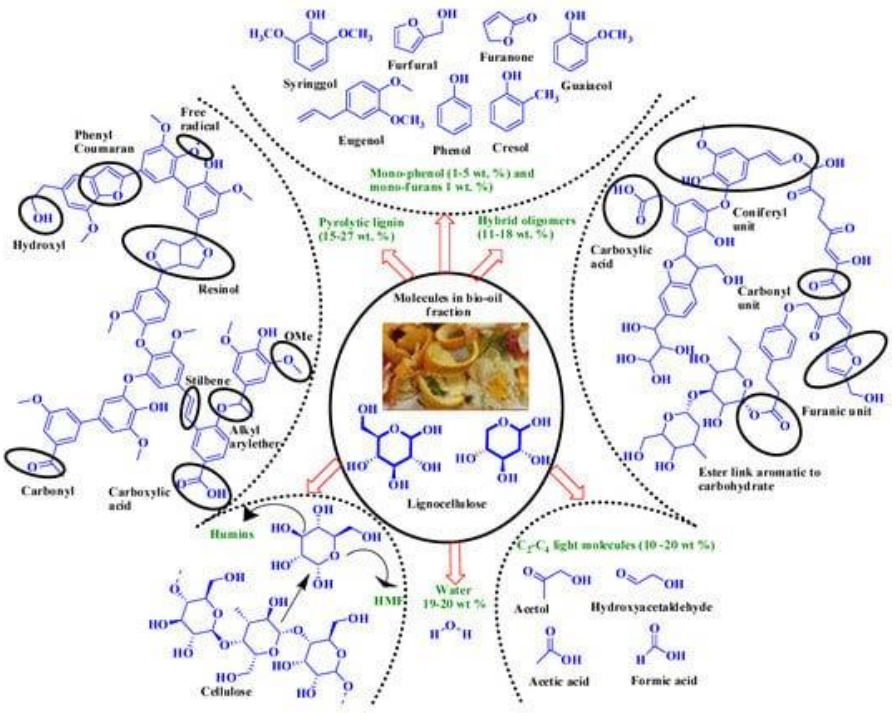

Figure 3. Chemical compounds from citrus waste biomass [10]

The waste can be used as raw material to produce several valuable chemicals and products such as bio-ethanol, biogas, bio-oil, organic acids, enzymes, etc. The production of these chemicals from waste biomass offers a cheap alternative to the harsh chemicals used in industrial synthesis as well as the ability to control pollution from waste released into the environment. Derivative chemicals can be further used in the production of industrially important chemicals, as solvents and building blocks of newer chemicals. Furthermore, organic acids, pectins, enzymes, prebiotics, etc., derived from citrus waste have advantages over their synthetic counterparts in practical applications in the food processing industry and pharmaceuticals [10].

4. Conclusion

Utilizing organic waste in agricultural production to manufacture useful products such as detergents and soap not only brings economic benefits but also helps reduce environmental pollution. Many countries around the world still face many difficulties in economic and social conditions. Therefore, studies using organic waste as sanitary products are really important. This article introduces some research on making hygiene products from orange and tangerine peels; and grapefruit peel. Besides being used to make cleaning products, other potential applications are also introduced to effectively exploit organic waste and solve the problem of environmental pollution.

Declarations

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The study has no funding from any institution.

Competing Interests Statement

The author declares having no competing interest with any party concerned during this publication.

Consent for Publication

The author declares that he consented to the publication of this study.

Authors' contributions

All research work is from the author.

References

[1] Ukaogo, P.O., Ewuzie, U., & Onwuka, C.V. (2020). Environmental pollution: causes, effects, and the remedies. Microor Subtain Environ Health, 2020: 419–429. https://doi.org/10.1016/B978-0-12-819001-2.00021-8.

[2] Singh, J. (2015). International conference on harmonization of technical requirements for registration of pharmaceuticals for human use. J Pharmacol Pharmacother., 6(3): 185–197. https://doi.org/10.4103/0976-500X.16200.

[3] Nnaemeka, A.N. (2020). Environmental pollution and associated health hazards to host communities (case study: Niger delta region of Nigeria). Cent Asian J Environ Sci Technol Innov., 1: 30–42. https://doi.org/10.4103/0976-500X.162004.

[4] Song, L., & Zhou, X. (2021). Does the green industry policy reduce industrial pollution emissions? - Evidence from China's national eco-industrial park. Sustainability, 13: 6343. https://doi.org/10.3390/su13116343.

[5] Bharvi, S.P., Bhanu, R.S., & Archana, U.M. (2021). Effect of eco-enzymes prepared from selected organic waste on domestic waste-water treatment. World J Adv Res Rev., 10: 323–333. https://doi.org/10.30574/wjarr.2021.10.1.0159.

[6] Chin, W.L., Leong, R.Z.L., & Sen. S.T. (2021). Effective Microorganisms in Producing Eco-Enzyme from Food Waste for Wastewater Treatment. Appl Microbiol Theo Tech., 2: 28–36. https://doi.org/10.37256/aie.212021726.

[7] Lapsia, V., & Makarand, N.C. (2020). Production, extraction and uses of eco-enzyme using citrus fruit waste: wealth from waste. Asian Jr of Microbiol Biotech Env Sci., 22: 346–351. https://doi.org/10.4108/eai.25-11-2021.2318816.

[8] Prarthana, P., Srikant, L., Milind, S., Nathan, B.P., & Alan, R.H. (2019). Antibacterial activity and absorption of paper towels made from fruit peel extracts. J Emerg Invest., 2: 1–7. https://doi.org/10.59720/19-005.

[9] Gan, C., Mengni, Z., Yang, L., Yanhui, Z., Bin, L., & Ee, V.L. (2024). A novel method for the green utilization of waste fried oil. Particuology, 84: 1–11. https://doi.org/10.1016/j.partic.2023.02.019.

[10] Neelima, M., Kavita, S., Mukty, S., Archana, D., Brajesh, P., Hyeji, J., Seorin, P., Srinath, P., & Sunghun, C. (2021). Biotransformation of Citrus Waste-I: Production of Biofuel and Valuable Compounds by Fermentation. Processes, 9: 220. https://doi.org/10.3390/pr9020220.